# Project – River discharge analysis

For better prevention of flood events, thus planning protection measures and mitigation actions it is important to analyze the discharge of rivers and the regarding water height, e.g. in order to estimate how likely a critical water height could be exceeded.

You are given daily measurements for the discharge of the two rivers Isar and Danube from 1925/11/01 to 2017/05/21 as they can be downloaded from Bayerisches Landesamt für Umwelt (www.gkd.bayern.de). The measurements are given for the gauge stations Plattling (Isar) and Hofkirchen (Danube). The estuarial area where the Isar River enters the Danube River lies in the area of the commune Moos south of Deggendorf and east of Plattling.


*Figure 1: Plattling at Isar and estuarial area of Isar River and Danube River, source: http://www.gkd.bayern.de/fluesse/abfluss/stationen/stammdaten.*

1. Conduct a basic descriptive statistical data analysis for the daily mean values for the two river gauge stations, i.e. determine mean values, depict the histograms, determine outliers etc. Plot the time series for both stations for the years 2015 to 2016 and compare. Determine if there are (linear) dependencies in the data sets of the two gauge stations and visualize. Give a concise summary of your findings.
2. Determine the annual mean and annual maximum values for Plattling over the period of 1971 to 2016. In which season/months do the maxima occur; is there a trend?
3. Determine the distributions of the 1) annual mean and 2) annual maximum discharge of the Isar River measured at the station Plattling i.e. perform distribution fitting to a number of models and find the possibly best fit for both cases. Assess the distribution fits graphically. How does the distribution of the mean values differ from the one of the maximum values? How could a distribution fit be evaluated quantitatively?

4. The rating curve of a river cross section describes the relation between discharge $Q$ and water height $h$. Examples of such relations for various locations on Bavarian rivers can be found online at http://www.hnd.bayern.de/. For the gauge station in Plattling the regarding function has to be determined and described based on the data available at http://www.hnd.bayern.de/pegel/isar/plattling-16008506/abflusstafel, see also Figure 2. Based on the functional fit you found for *h(Q)*, compute the mean annual water height applying Monte Carlo simulation with 1000 samples.

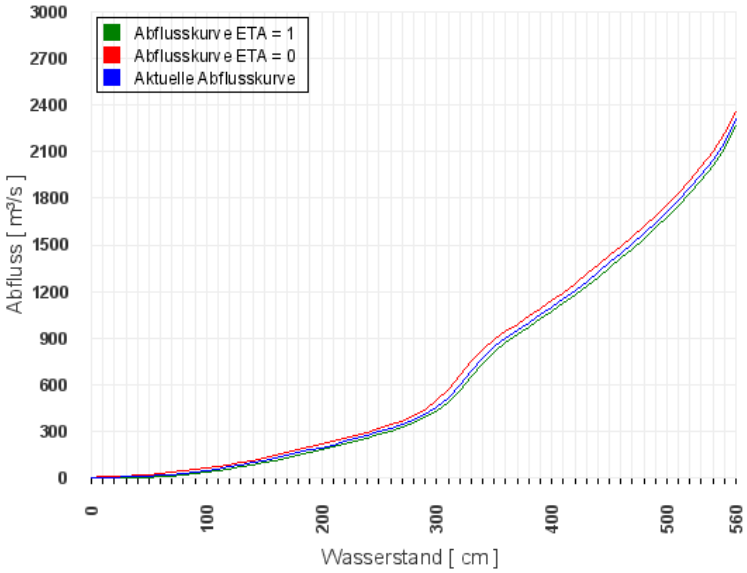


*Figure 2: Rating curve for water height h [cm] and discharge Q [m³/s] for the gauge station Plattling. Source: http://www.hnd.bayern.de/pegel/isar/plattling-16008506/abflusstafel.*

5. It is assumed that the critical water height whose exceedance would cause a flooding event is $h_{cr}$=4.7 m. Compute the annual probability that the water height exceeds the threshold $h_{cr}$. The number of samples should be chosen such that the coefficient of variation of the estimate is smaller than 10%.

6. Find out, whether your final results are sensitive to changes in assumptions made for the function of *h(Q)*, and how important (large) the sensitivity is.

Please submit the MATLAB codes and a final structured and concise report that summarizes your results with explanations where needed, until June 30. Cite correctly, if you use additional literature or internet sources. Title figures and tables, use axis labels, units etc.

**Date of submission: June 30, 2017**